



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(71) Applicant (for all designated States except US): SAFETY ADHERENCE TECHNOLOGY (PTY) LTD [ZA/ZA]; 2nd Floor, Lynwood Galleries, Rosemary Road 354, Lynwood, 0001 Pretoria (ZA).			
(72) Inventor; and		Published	
(75) Inventor/Applicant (for US only): MARAIS, Benjamin, Webber [ZA/ZA]; 23 Lightning Shot Road, Stand 378, Mooikloof Estates, 0001 Pretoria (ZA).		With international search report.	
(74) Agent: MCCALLUM, RADEMEYER & FREIMOND; 7 June Avenue, 2194 Bordeaux (ZA).			
<b>(54) Title:</b> SURVEILLANCE SYSTEM			
<b>(57) Abstract</b>			
<p>A surveillance system for a plurality of critical locations which includes a plurality of cameras (16A–16D), each camera being trained on a respective critical location, a central station (20), a plurality of monitors at the central station which display images from the cameras, detector devices (24A–24D) for detecting movement at each critical location, signal apparatus responsive to the detector devices for providing a signal when movement is detected, and recorded apparatus for recording the identity of personnel entering or leaving each critical location.</p>			

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## SURVEILLANCE SYSTEM

### BACKGROUND OF THE INVENTION

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This invention relates to a surveillance system suitable for monitoring high risk plants and in particular the conduct of personnel in terms of safety regulations.

At present so-called "safety workers personnel" are utilised to guard, observe, and take  
10 prescribed action when required, in potentially hazardous work places. These personnel monitor the environment and conditions which may pose a potentially dangerous situation for a workman.

The use of such personnel is expensive and is subject to human error. If an accident  
15 should occur then the account of the circumstances which gave rise to the accident is at least partially dependent to the subjective recollection by the personnel of what happened.  
This is not an entirely satisfactory situation.

When work is performed in hazardous work places there are, in most countries, two basic  
20 legal requirements which must be met. Firstly the work place must be continuously visually observed and, secondly, if an emergency situation arises then corrective measures must be implemented as quickly as is reasonably possible.

### SUMMARY OF THE INVENTION

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The invention is concerned with a surveillance system which enables critical or hazardous

5 locations to be monitored more effectively and at a lower cost.

The invention provides a surveillance system for a plurality of critical locations which includes a plurality of cameras, each camera being trained on a respective critical location, a central station, a plurality of monitors at the central station which display images from 10 the cameras, detector devices for detecting movement at each critical location, signal apparatus responsive to the detector devices for providing a signal when movement is detected, and recorder apparatus for recording the identity of personnel entering or leaving each critical location.

15 The signal which is provided when movement is detected may be of any appropriate kind and preferably is audible. The signal may alternatively or additionally be visual. The signal may be provided at the location at which movement is detected and additionally at the central station.

20 The occurrence of each signal may be recorded at the central station.

Similarly the images which are displayed on the monitors may also be recorded and retained at least for a predetermined minimum time period.

25 Sensors may be provided at each location for detecting unwanted or dangerous events for example the presence of dangerous or noxious gasses.

The central station may be fixed or mobile, depending on requirement.

- 5 The images which are obtained from the cameras may be transmitted to the monitors at the central station using wireless techniques or by making use of cables.

The surveillance system may include an uninterruptible power supply which ensures that the cameras and monitors, and other power dependent equipment, can function  
10 continuously.

The system may include one or more mobile cameras, which are carried by personnel, and which may be used in conjunction with the aforementioned trained cameras to record images and information at any location according to requirement.

15

#### BRIEF DESCRIPTION OF THE DRAWINGS

The invention is further described by way of example with reference to the accompanying drawings in which:

- 20 Figure 1 is a schematic representation of a remote surveillance station used in the system of the invention,

Figure 2 schematically illustrates a surveillance system according to the invention, and Figure 3 illustrates monitors used at a central station in the surveillance system.

25 DESCRIPTION OF PREFERRED EMBODIMENT

Figure 1 of the accompanying drawings is a schematic representation of a remote surveillance station 10 used in a surveillance system according to the invention.

5      The surveillance station is, in this example, provided for monitoring a vessel 12, e.g. a cylinder which normally contains dangerous liquids or gases, which constitutes a hazardous work place. In this example the vessel 12 has four manholes 14A, 14B, 14C and 14D respectively and it is assumed, for illustrative purposes, that the vessel is accessed through the manholes for maintenance or other purposes. This is given merely  
10     by way of a non-limiting example.

The surveillance station includes video cameras 16A to 16D which are respectively trained on the manholes 14A to 14D. The cameras are connected by means of suitable cable links 18 to a remote central surveillance station 20 which is further described hereafter.

15     Each camera has a field of view which adequately covers the respective manhole and surrounding area. An audiovisual alarm plug point 22A to 22D is provided at each respective manhole. Similarly each manhole has a respective sensor 24 and a video plug point 26 for a roving or mobile camera.

20     Figure 2 illustrates a surveillance system 30 according to the invention. The system includes a plurality of remote surveillance stations 10A ..... 10N, each of the kind shown in Figure 1, and a central control station or room 32 to which the remote central surveillance stations 20A ..... 20N are connected. In this regard use is made of wireless  
25     or cable links 34.

Mobile personnel 36 carry video cameras 38. These personnel are free to move within an area 40 which is monitored by the surveillance system 30.

- 5 The system also includes video cameras 42 which are mounted at strategic locations in  
the area 40 and which are remotely controllable from the central station 32. The cameras  
42 can be controlled at least in pan, tilt and zoom modes.

10 The central control room 32 may be fixed or mobile. As is shown in Figure 3 the central  
control room 32 has a plurality of monitors 50A, 50B .... 50N. Each monitor is capable of  
displaying four images in respective quadrants of a display screen. The monitor 50A is  
associated with the remote surveillance station 10A, the monitor 50B with the remote  
surveillance station 10B, and so on. The images which are displayed on each respective  
monitor are derived from the respective video cameras 16A to 16D at each surveillance  
15 station.

Separate monitors are provided for the pan, tilt and zoom cameras 42.

20 A multi-channel time lapse video recorder 52 is located at the station and is connected to  
the links from the various video cameras included in the surveillance system. In this way  
a record is kept, for a predetermined time, of the images which are presented on the  
various screens.

25 The sensor 24 at each manhole detects movement around the manhole, for example a  
workman entering or exiting the manhole. The sensor includes a buzzer or siren and,  
optionally, a light source. When movement is detected an audible alarm is sounded by  
means of the buzzer or siren and, if required, a visual signal e.g. the light source is  
actuated and is caused to flash. The alarm is sounded until such time as the workman in  
question is identified by the system. This may be done in various ways. For example each

5 workman may carry a uniquely encoded magnetic card which is presented to a card reader  
60 at the respective manhole. The identity data on the card is read and is then transmitted  
to the remote central surveillance station 20 for onward transmission to the control room  
32, for logging. Alternatively each workman may be given a passive transponder which is  
interrogated by the sensor. In this way identity data on each worker entering or leaving the  
10 manhole is automatically gathered and transmitted to a logging device 64 at the control  
room 32.

The signal which is generated when movement is detected may also be generated at the  
control room 32. Buzzers 66 may be used to alert the workman and the control room if the  
15 entry or exit of a worker is not recorded.

Personnel at the central control room 32 monitor the screens 50 on which the images from  
the various cameras are presented. If any untoward event should occur then these  
personnel can initiate emergency action immediately.

20 The sensors 24 at the manholes also monitor each manhole for hazardous occurrences  
such as the emission of dangerous gas. Again an audible or visual alarm signal can be  
generated to alert personnel that appropriate action must be taken.

25 The mobile personnel 36 within the area 40 can move freely to each of the locations which  
are being monitored, according to requirement. At each location which is regarded as  
hazardous a video plug point 26 is provided. The mobile cameras 38 which are carried by  
the roving personnel can be plugged into these points to provide additional images,  
produced by the mobile cameras, to the central control room.

5      Radio links are provided between each remote central surveillance system and the central control room. Information produced by the various sensors, movement detectors, card readers and the like is initially collected at each respective remote control surveillance station 20, which then transmits the information to the central control room 32. If the personnel at the central control room detect non-compliance with safety procedures or an  
10     emergency then audiovisual warnings which are initiated at the central control room are transmitted to the corresponding remote central surveillance station and are directed to the associated remote surveillance station either to warn a workman that safety procedures are not being adhered to or to evacuate the area in question.

15     If a workman is outside a manhole and his magnetic card has not yet been read then a flickering light can be used to prompt the workman to ensure that his identity data is read.

If hazardous gasses are detected by the sensors 24 then this information is also transmitted to the central control room and a siren or other warning signal is initiated to  
20     warn workmen to evacuate the affected area.

The audiovisual alarm plug points 22 are positioned at each respective manhole to provide a facility for the installation of warning lights and signals.

25     Referring to Figure 2 the system 30 is preferably powered by means of an uninterruptible power supply 70 to ensure that the monitoring function continues despite mains power interruptions.

The personnel at the central control room can perform the following functions:

- 5 (1) they can continuously visually follow the adherence to safety regulations by workmen at hazardous areas;
- (2) they can detect when a workman fails to comply with safety procedures and, as has been pointed out, in this event a signal is also generated at the central control room;
- 10 (3) they can be alerted to hazardous situations via the sensors 24;
- (4) they can warn a workman if safety procedures have not been complied with;
- (5) they can alert workmen if potentially hazardous situations arise;
- (6) they can direct the roving personnel 36, by radio links, to perform certain tasks including replacing faulty equipment; and
- 15 (7) they can capture and document visual activity, card reader movement, sensor alarms and the like, using the recorder 52 at the central control room.

The material which is recorded on the recorder 52 is kept for a specified period if no accident or potentially hazardous situation or incorrect procedures occur. Thereafter, 20 subject to authorisation, the recorded material may be erased.

The material which is available at the central control room may be distributed via modem or other links to any appropriate destination.

25 A significant benefit of the invention is that the cost of monitoring a given area is significantly less than the cost which is incurred by making use of conventional techniques. In addition as the surveillance takes place at a protected central control room operating conditions for the personnel involved are enhanced and the likelihood of an error occurring is reduced. A complete visual and audible record can be kept of all of the activities at each

- 5 hazardous location and if an unwanted or dangerous event occurs it is possible to reconstruct the sequence of events leading up to the occurrence more accurately.

In many industrial plants the requirements for surveillance personnel or safety watcher can fluctuate quite significantly. Mobilisation of surveillance personnel, even with ample  
10 notification, may be difficult. On short notice it may sometimes be impossible to mobilise surveillance personnel. These problems are substantially reduced through the use of the surveillance system of the invention.

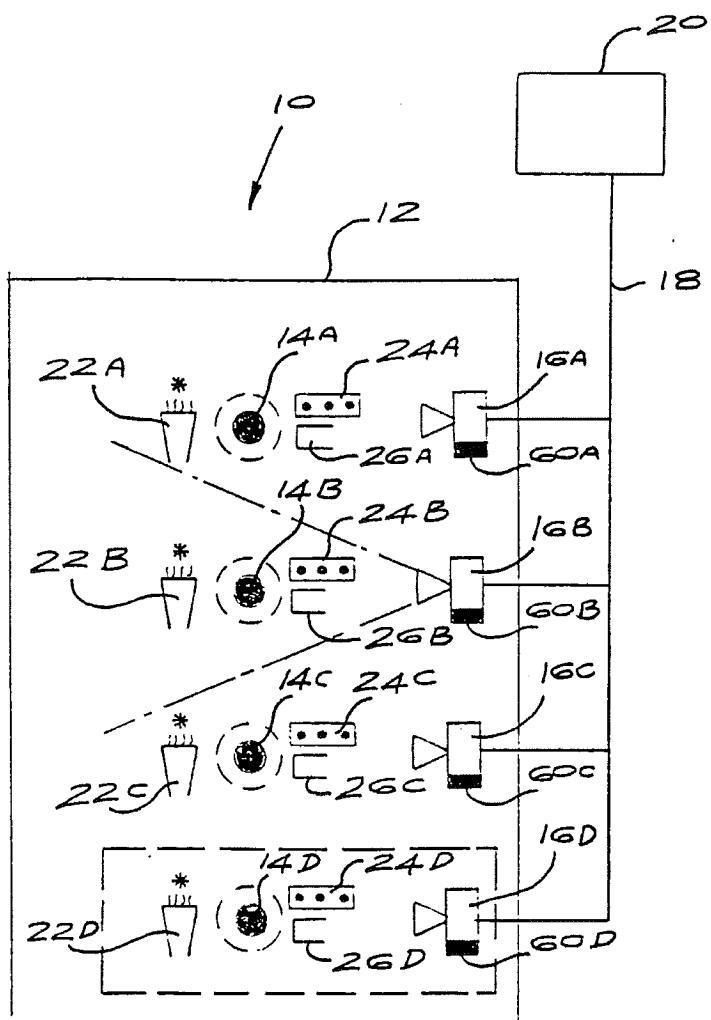
15

5      CLAIMS

1. A surveillance system for a plurality of critical locations which includes a plurality of cameras, each camera being trained on a respective critical location, a central station, a plurality of monitors at the central station which display images from the cameras, detector devices for detecting movement at each critical location, signal apparatus responsive to the detector devices for providing a signal when movement is detected, and recorder apparatus for recording the identity of personnel entering or leaving each critical location.
- 10        2. A surveillance system according to claim 1 wherein the signal apparatus provides a signal which causes at least one of: an audible alarm and a visual alarm.
- 15        3. A surveillance system according to claim 2 wherein the signal apparatus is provided at least at the location at which movement is detected.
- 20        4. A surveillance system according to claim 2 or 3 which includes a recorder, at the central station, for recording the occurrence of each signal.
- 25        5. A surveillance system according to any one of the claims 1 to 4 which includes a recorder device for recording the images which are displayed on the monitors.
6. A surveillance system according to any one of claims 1 to 5 which includes sensors at each location for detecting unwanted or dangerous events.

- 5        7        A surveillance system according to any one of claims 1 to 6 wherein the images  
which are obtained from the cameras are transmitted to the monitors at the central  
station using wireless techniques.
- 10      8.        A surveillance system according to any one of claims 1 to 7 which includes an  
uninterruptible power supply which ensures that the cameras and monitors, and  
other power dependent equipment, can function continuously.
- 15      9.        A surveillance system according to any one of claims 1 to 8 which includes one or  
more mobile cameras, which are carried by personnel, and which are used to  
record images and information at any location according to requirement.

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2/2

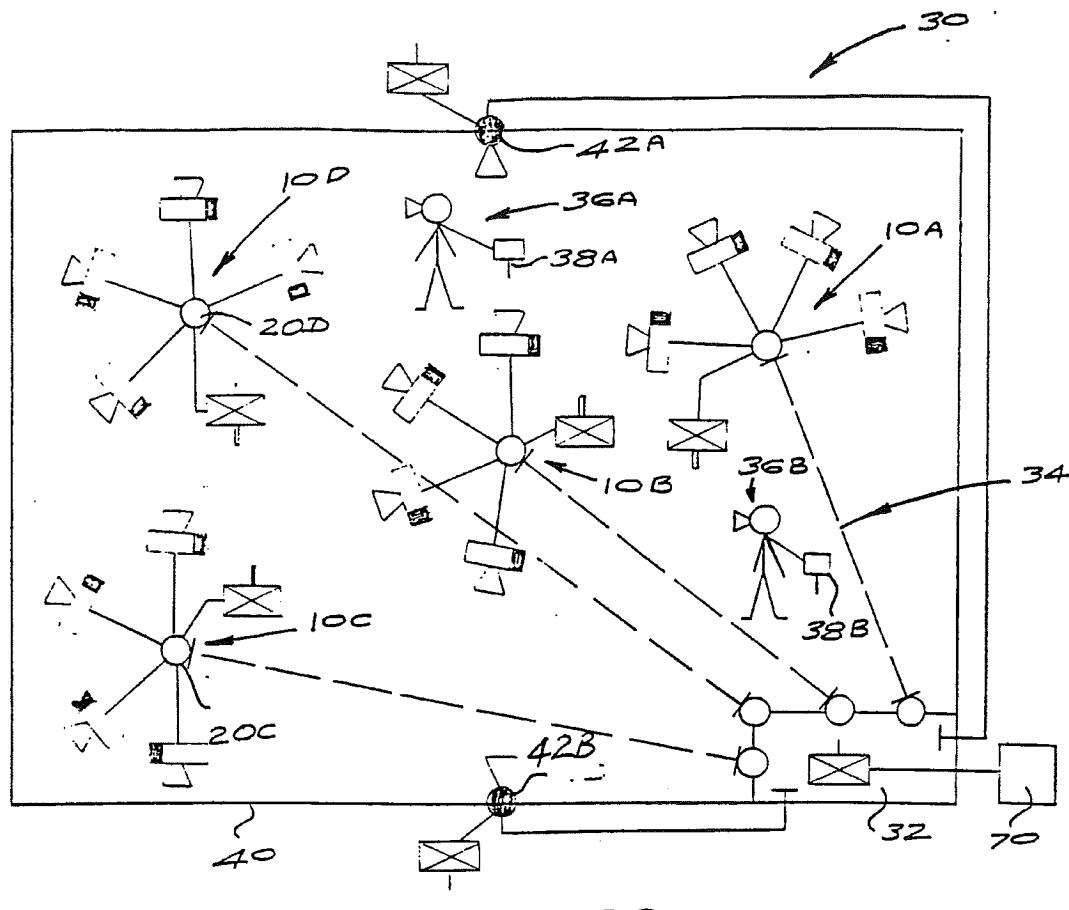


FIG 2

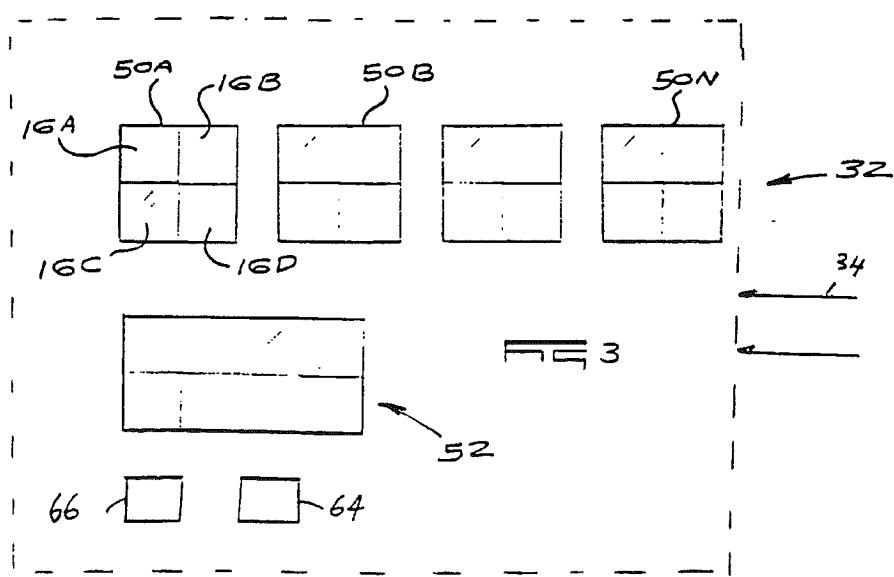


FIG 3

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# INTERNATIONAL SEARCH REPORT

Int'l Application No  
PCT/ZA 00/00092

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 G08B15/00 G08B13/14

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G08B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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Date of mailing of the international search report

17 August 2000

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NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

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Kelperis, K

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**INTERNATIONAL SEARCH REPORT**

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**C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT**

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Information on patent family members

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